

Application No. 10/063,808
Docket No. 13DV-13711
Amendment dated October 10, 2003
Reply to Office Action of July 10, 2003

REMARKS

In the Office Action, the Examiner reviewed claims 1-34 of the above-identified US Patent Application, with the result that the declaration, specification and drawings were objected to, claims 1-3, 5-13, 15-20, 22-30, and 32-34 were rejected under 35 USC §103, and claims 4, 14, 21, and 31 were deemed to recite allowable subject matter. In response, Applicants have amended the specification and claims as set forth above. More particularly:

The specification has been amended at paragraph [0004] to make reference to the crucible wall 18, which appears in Figure 1 but was inadvertently omitted in the specification.

The specification has been reviewed and amended to correct clerical matters in paragraphs [0003], [0007], [0023], and [0024], and to clarify that in paragraph [0008] that "the melting means" operates to both "melt and evaporate the first and second materials at different rates." The basis for the amendment to paragraph [0007] is that, as well known in the art, the gamma prime phase is a nickel-base intermetallic while the gamma phase is not. Support for the amendment to paragraph [0008] can be found in Applicants' specification at paragraphs [007] and [0019].

A substitute Abstract has been presented in response to the objection to the specification.

Independent claims 1, 13, 18, and 30 have been amended to specify that the

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first and second materials are melted at different rates as a result of being subjected to "different power level inputs." Support for these amendments can be found in Applicants' specification at paragraphs [0018] and [0019].

Applicants believe that the above amendments do not present new matter. Favorable reconsideration and allowance of claims 1-34 are respectfully requested in view of the above amendments and the following remarks.

Oath/Declaration

The Examiner advised that Applicants' oath was defective, as not properly identifying the residences of the Applicants. In response, Applicants submit herewith a "Supplemental Declaration and Power of Attorney" that addresses this matter. Therefore, Applicants respectfully request withdrawal of this objection.

Objection to the Specification

The Examiner objected to the specification under MPEP 608.01(b) for having an abstract with greater than 150 words. Applicants believe that their Abstract as-filed contained only 148 words (including reference numbers). Nonetheless, Applicants have amended their Abstract to further reduce its length, and therefore also respectfully request withdrawal of this objection.

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Objection to the Drawings

The Examiner objected to the drawings for containing a reference number not found in the specification. As noted above, Applicants have amended their specification at paragraph [0004] to make reference to the wall 18 of the crucible 12 shown in Figure 1. Accordingly, Applicants respectfully request withdrawal of the Examiner's objection to the drawings.

Rejections under 35 USC §103

Independent claims 1, 13, 18, and 30 and their dependent claims 2, 3, 5-12, 15-17, 19, 20, 22-29, and 32-34 were rejected under 35 USC §103(a). Claims 1-3, 5, 6, 8-13, 15, 16, 18-20, 22, 23, 25-30, 32 and 33 were rejected as being unpatentable over U.S. Patent No. 6,174,571 to Corderman et al. (Corderman) in view of U.S. Patent No. 6,042,898 to Burns et al. (Burns), and claims 7, 17, 24, and 34 were rejected as being unpatentable over Corderman in view of Burns and in further view of U.S. Patent No. 5,296,274 to Movchan et al. (Movchan). Applicants respectfully traverse each of these rejections in view of the following comments.

Applicants' invention is directed to a physical vapor deposition (PVD) process and apparatus (120) for depositing a coating (132) from multiple sources (110,111) of different materials. The process and apparatus (120) are particularly well

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suited for depositing a nickel-base intermetallic coating (e.g., beta-phase (β NiAl)) alloyed to contain an element (e.g., zirconium, hafnium, yttrium, cerium, etc.) whose vapor pressure is significantly lower than the constituents of the nickel-base intermetallic. According to the invention, a different evaporation rate for the low vapor pressure element(s) is necessary to achieve higher deposition rates and better control of the coating chemistry, and different evaporation rates are achieved by operating a melting/generating means (128) to deliver different power level inputs to the first and second materials.

Under the first §103 rejection, the Examiner explained that Corderman discloses Applicants' invention except for "electron beams melt[ing] the first and second materials at different rates," but concluded that "when the materials are different, they will melt at a different rate." The Examiner then cited Burns for disclosing the deposition of a MCrAlY alloy as part of a thermal barrier coating, and concluded that "[i]t would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the composition taught by Burns to form a barrier coating"

As noted above, Applicants teach and claim a process and apparatus (120) for depositing a coating by evaporating a first material (110) and a second material (111) containing a low vapor pressure element to yield a coating (132) that contains the first and second materials. Applicants require that different evaporation rates are

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deliberately used for the first and second materials (110,111), and that the different evaporation rates are achieved by operating a melting/generating means (128) to deliver different power level inputs to the first and second materials (110,111). In contrast, Corderman merely discloses:

- coatings (deposits) 170 can be deposited from multiple pools 130 of molten metal (Figure 3; column 6, lines 48-53);
- the sources of the molten metal pools 130 can be ingots (column 3, lines 47-53);
- ingot feed rates can be adjusted to keep the molten pool surface at a constant level to obtain specific deposit compositions (column 3, lines 53-57);
- the deposited material can include NiAl intermetallic (column 5, line 16; column 6, line 66);
- the deposited material may have a low vapor pressure, in which case the heating means (electron beam 150) is rastered over the top surface of the molten pool 130 (column 3, lines 58-63); and
- the energy supplied to the molten pool 130 by the electron beam 130 can be adjusted (column 6, lines 10-12).

However, Corderman is limited to teaching that differences in chemical composition of a deposit (coating) 170 arise "due to the substrate being horizontally displaced from a perpendicular line extending upward from the molten surface of the

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vapor source," and that "the composition of the deposit on the substrate fluctuates depending on the horizontally displaced distance of the workpiece from such line" (column 7, line 59-column 8, line 10). As such, Corderman teaches achieving a particular composition for a deposit 170 by appropriately locating the targeted substrate relative to the vapor source 130 (column 1, lines 60-65).

In view of the above, Corderman does not teach or suggest deliberately using different power level inputs to different vapor sources (pools 130) in order to tailor the chemistry of the resulting deposited coating 170. To the contrary, Corderman is limited to disclosing the use of a single power level input (20 kW in Examples 1 and 2).

Applicants acknowledge Corderman's teachings regarding the ability to deposit "additional alloying elements" from "additional evaporation sources," and the Examiner's contention that "when the materials are different, they will melt at a different rate." However, Corderman does not disclose that the different materials are actually or intentionally evaporated at different rates, and in any event Corderman does not disclose deliberately adjusting the power level input to the vapor sources (pools 130) in order to intentionally evaporate the vapor sources 130 at different rates for the purpose of tailoring the chemistry of the deposited coating 170.

In view of the above, it is apparent that Burns does not supplement the teachings of Corderman in order to arrive at Applicants' invention, since Burns merely discloses depositing a MCrAlY coating (which is not a nickel-base intermetallic) from a

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single vapor source. Therefore, Applicants respectfully request withdrawal of the first rejection of the claims under 35 USC §103(a).

Movchan was applied in combination with Corderman and Burns on the basis of teaching that a vapor source can be replenished by feeding a wire of the source material to a molten pool of the source material. Therefore, it is apparent that Movchan does not supplement the teachings of Corderman and Burns in order to arrive at Applicants' invention, and Applicants also respectfully request withdrawal of the second rejection of the claims under 35 USC §103(a).

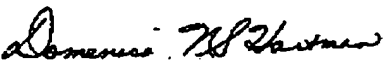
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Closing

In view of the above, Applicants believe that all issues outstanding from the Office Action have been addressed, and that the claims define patentable novelty over all the references, alone or in combination, of record. It is therefore respectfully requested that this patent application be given favorable reconsideration.

Should the Examiner have any questions with respect to any matter now of record, Applicants' representative may be reached at (219) 462-4999.

Respectfully submitted,

By 
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October 10, 2003
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Attachments: Supplemental Declaration and Power of Attorney
Replacement Abstract of the Invention

ABSTRACT OF THE DISCLOSURE

A PVD process and apparatus (120) for depositing a coating (132) from multiple sources (110,111) of different materials. The process and apparatus (120) are particularly intended to deposit a beta-nickel aluminide coating (132) containing one or more elements zirconium, hafnium, yttrium and/or cerium, whose vapor pressures are sufficiently lower than NiAl to ~~require a different evaporation rate in order to achieve higher deposition rates and better control of the coating chemistry.~~ The PVD process and apparatus (120) entail feeding at least two materials (110,111) into a coating chamber (122) and evaporating ~~melting~~ the materials (110,111) at different rates ~~from to form~~ separate molten pools (114,115) thereof. Articles (130) to be coated are suspended within the coating chamber (122), and transported with a support apparatus (118) relative to the two molten pools (114,115) so as to deposit a coating (132) with a controlled composition that is a mixture of the first and second materials (110,111).

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**SUPPLEMENTAL DECLARATION AND POWER
OF ATTORNEY FOR PATENT APPLICATION**

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on this invention entitled:

PHYSICAL VAPOR DEPOSITION APPARATUS AND PROCESS

the application of which

OR _____ is attached hereto

X was filed on May 15, 2002 as United States Application Serial Number 10/063,808 and claims priority to US Provisional Patent application Number 60/343,791, filed October 19, 2001.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations §1.50.

I hereby claim foreign priority benefits under Title 35, United States Code §119 (a)-(d) or §365 (b) of any foreign application(s) for patent or inventor's certificate, or §365 (a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Priority
Claimed ?

| (Number) | (Country) | (Day/month/year filed) | Y | N |
|----------|-----------|------------------------|---|---|
|----------|-----------|------------------------|---|---|

____ Additional foreign application numbers are listed on a supplemental priority data sheet attached hereto

I hereby claim the benefit under Title 35, United States Code §119 (e) of any United States provisional application(s) listed below.

| | |
|----------------------|-------------------------|
| <u>60/343,791</u> | <u>October 19, 2001</u> |
| (Application Number) | (Filing Date) |

____ Additional provisional application numbers are listed on a supplemental priority data sheet attached hereto.

I hereby claim the benefit under Title 35, United States Code §120 of any United States Application(s), or §365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

I hereby appoint the registered practitioners associated with Customer Number 30952 to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

Address all telephone calls to Gary M. Hartman at telephone number 219-462-4999.

Address all correspondence to the correspondence address for Customer Number 30952.

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I hereby declare that all statements made herein of my own knowledge are true and that all states made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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